## Subject Index

Actinolite 190, 295 adamellite 311 age determinations, granites 350 f. åkermanite - monticellite coexistence 143f -, stability 145f. -, -, effect of solid solution 148 albite 47, 124, 224, 230, 295 alkali feldspar 124, 318 - solvus 202 Al/Si disorder, cordierites 135f. -, feldspars 123f., 135 amphibolite 38, 248 andesine 345 andesite 167, 273, 287, 329 anhydrite 224, 285, 295, 418 ankerite 295 anorogenic granites 311 ff. anorthite 30, 148 -, enthalpy of fusion 95f. anorthosite 143, 245 apatite 145, 341 ff. -, CI/F ratios, hornblende granolite 343 40Ar-39Ar dating 109ff. augengneiss 235, 245 augite 1, 329, 339

authigenic minerals. Salton Sea sandstones

295f.

Barite 285
basalt 167, 190

-, lceland 362 ff.

-, -, liquidus temperatures 366

-, Indian ocean 387 ff.

-, melt density 7f.
biotite 223, 235, 296 f., 341

-, age determinations 249 ff.

-, chemical variation with depth 305

- granites 318

-, high-grade metamorphic rocks 245 f.
boninites 329 f.
bronzite 329
burial metamorphism 293
bustamite 253 f., 261, 418

- rhodonite coexistence 265

- rhodonite coexistence 265 Calcite 144, 295 -, Mn-~ 417 cation exchange, granulites 201 f. celadonite 111 chalcopyrite 285 charnockites 144, 235f., 245 chemical analysis -, åkermanite-coex. minerals 149 -, amphibolite, Gwenoro Dam 38 -, apatites, hornblende-granolites 342 -, basaltic glass, Indian ocean 392 -, basalts, Iceland 363 -, -, Indian ocean 392 -, -, Reykjanes Ridge 363 -, -, standard rocks 390

-, biotites, authigenic, Salton sandstones

-, -, Rogaland migmatites 247

304

-, chlorite, authigenic, Salton sandstones 302 -, chloritoid rocks, Helen Mine 166 -, -, coexisting minerals 168 -, clinoenstatites, boninites 334 -, clinopyroxenes, Mn-rich 420 -, cordierite, Rogaland migmatites 240 -, cordierite glass 136 -, glass, boninites 333 -, gneiss, Gwenoro Dam 38 -, granulite minerals, Scotland 156 -, greenstones, Norway 378 -, hercynite, Rogaland migmatites 240 ignimbrites, Sa. Madre Occ. 274 K-phlogopites, Algeria 227 -, magnetite, Rogaland migmatites 240 -, muscovite, two-mica granites 317 Na-phlogopite, Algeria 227 -, olivine, Indian ocean 399 ophiolites, Mediterranean area 197 -, phengites, Gran Paradiso 118 -, plagioclase, Indian ocean basalts 399 -, pyroxenes, Indian ocean basalts 399 -, rhodonite-bustamites, Meldon 266 -, scapolite, coex. with plagioclase 346 -, sericite, Salton sandstones 298 -, talc, Algeria 229 ultramafic granulites 155 -, volcanics, Pindos 192 -, -, clinopyroxenes 192 chert 167, 285, 376 chlorite 47, 166, 190, 224, 249, 296f. chloritoid 111 - stability, pillow lavas 165f. -, breakdown reactions 169f. CI, coex. apatite/hornblende 344 -, enrichment in granolites 345 claystones 224 clinoenstatite, volcanics 329ff. clinopyroxene 155, 190, 253f., 273, 329f., 406f., 419 - fractionation, oceanic basalt suites 369 CO<sub>2</sub>, solubility in silicate liquids 55f. contact metamorphism 144 cordierite 201, 235f. -, distortion 135f. hercynite relations 239 crystallization, boninite magma 336f. sequence, experim., Iceland basalts 365f. crystal-ring microstructures 1 f. cuspidine 144 Dacite 167, 273

dannemorite 418

diabase 167

diaspore 235

diopside 144

diagenesis 293 diapirs 224

deltaic sediments 294f.

differentiation, granites 323

deformation, Damara Belt 349ff.

-, boninites 333

diorite 248 distortion index, cordierites 135f. dolerites 190 dolomite 224, 295 dolostones 224 domains, feldspars 128f. dvkes 190 Eclogite 153 element mobilisation, Pindos pillow lavas 193f enthalpy of fusion, anorthite 95ff. - of vitrification 98 epidote 47, 295, 341 epitaxial nucleation 75 equilibration temperatures, garnet Iherzolites 403ff. equilibria, åkermanite-coex. minerals 149f. equilibrium temperature estimation, garnet Iherzolites 403f. Eu anomaly, migmatite genesis 38 evaporites, Algeria 224 exchange reactions, biotite/chloride solution 87 exsolution, Mn-pyroxenes 418 - lamellae, pyroxenes 202 Favalite 144 feldspars, morphology of twins 81 -, structure 123f. -, twin law frequencies 80 ferrobustamite 418 ferrosilite 158 forsterite 144 fractional crystallization, granites 321 f. -, Iceland basalts 361 f. -. Sa. Madre volcanics 279f. fractionation, basaltic melts 7f., 369 Gabbro 191 eclogite transition 153 galena 176, 285 garnet 201 f., 235, 307, 339 - cordierite equilibria 203f. -, decomposition reactions 156f. - granolite 339f. Iherzolite nodules 403ff. - -, calculated temperatures 404 - -, Lesotho, late Cretaceous geotherm 414 geobarometry 208 geochronology, Arabian shield 177ff. -, granitic rock suite 45ff. -, Gran Paradiso 109ff. geothermal metamorphism 297f. geothermometry 203f. -, correlation between individual geothermometers 408 Fe<sup>2+</sup> – Mg<sup>2+</sup> partitioning between coex. minerals 409 ff. -, garnet lherzolites, methods 403ff. two-pyroxene solvus 407f.

glass 331, 366

gneiss 36, 45, 248, 341 granite 248 -, Damara tectonothermal development 351 ff. - plutonism, anorogenic 311ff. -, two-mica granites 316f. - system, melting 29ff. granodiorite 46, 177, 272 -, Damara 352f. granolites 339ff. granulite 153f., 201 ff. - facies 144, 235f. -, formation 207 greenschist facies 245 -, greenstones 377 greenstones, Norway, geochemistry 375ff. -, tectonic setting 383 grossular 144 gypsum 285

H, isotopic composition, altered host rocks around sulfide ores 290 halite 224 harkerite 145 harzburgite 14, 400 hedenbergite 253, 419 hematite 295 hercynite 235f. magnetite relations 237 high-cordierite 136f. H<sub>2</sub>O content, magmas 211 ff. hornblende 273, 339f. - granolite 339f. hortonolite 255 hyaloclastites 190 hypersthene 235, 339

Ignimbrites, Sa. Madre, geochemistry 271 ff.
illite 294
—, correlation X-ray/chemical composition 301
ilmenite 166, 316
ilmenomagnetite 155
incompatible elements, basalts 397
intrusion ages, granites 349
inversion, feldspars 125f.
isotopic composition, O in sericite and quartz, sulfide ore deposits 287f.
—, O in surrounding rocks 290

Jadeite 158 johannsenite 253f., 261, 422

Kanoite 421
K-Ar determination, metamorphic biotites 249
kaolinite 294
K-feldspar 47, 123f., 316
–, Pb geochronology 177
–, plagioclase inclusions 82
komatiites 427
kyanite 30
– sillimanite isograd 67 f.

Lahars 272
larnite 144
lavas, ignimbritic 272 f.
lead isotopes, S. Arabian ore deposits 175 ff.
leucogranite 46
leucoxene 166
lherzolite 14
liquid density versus basalt fractionation 8
liquidus temperatures, Iceland basalts 366
lopolith 245

Magma, basaltic, fractionation 369 -, H<sub>2</sub>O solubility, thermodynamic model 211f. magnesite 224 magnetite 47, 235f., 273, 316 mantle mixing 361 f. - peridotite 7 - plume, Iceland 361 f. marble 143 margarite 111 melilite minerals 144f. melting experiments, basalts, Iceland 365f. -, granite system 29 ff. -, mantle material 13ff. melts, basalts 7f. -, silicate, CO<sub>2</sub> dissolution 55f. merwinite 144f. mesoperthites 202 metamorphic rocks, mixing models 103f. metamorphism 143f. Adirondacks 417f. Antarctic granulites 201 ff. -, Damara granites 358f. -, granulites 153ff. -, high-grade 153f. kyanite-sillimanite isograd 67 -, Rogaland 235f., 245 -, -, mineral relations 237f. metasomatism, migmatites 35 Mq-cordierite 201f. -, distortion 135f.

micas 223f., 296f.

–, high-pressure metamorphic 109 ff.

–, peraluminous granites 316
microcline 123f., 295
microlite, pyroxenes 330
microphenocrysts, pillow basalts 1
microstructures, pillow lavas 1 f.
mid-ocean ridge basalts, phase diagram 13 ff.
migmatites 235f., 245, 248

–, origin 35f.
mixed layer, saponitic 223

Mn-pyroxenes 418

–, stability relations 253 ff.

Mn-rhodonite 418
monticellite 144 f.
montmorillonite 294
muscovite 30, 294, 316, 341

, talc/chlorite, regular 224

Mn-bustamite 255

Na-phlogopite, natural occurrence 223 ff. -, low-temperature hydration 223 norite 248 O, isotopic composition, sulfide ore associated minerals 287 oceanic basalts, fractionation 369 O-isotopes, computer calculation 107 olivine 1,7,14,144,190,329,366,399 – crystallization, basalt experiments 364 f. – protoenstatite relationship 336 ophiolites, Pindos 189 ff. –, geochemical trends 195 f. orogenic events, Damara belt 349 ff. orthoclase 235,295 – microcline inversion 123 ff. orthopyroxene 14,144,155,235,273,336,419 osumilite 201,235

Paragonite 111 para-wollastonite 253 pargasite 155 partial melting 13 -, Iceland basalts 361 f. -, Sa. Madre volcanics 280 f. partitioning, Fe-Mg between biotite and chloride solution 85f. -, olivine/biotite 88 pegmatites 36 pegmatoid veins with primary scapolite 345f. pennine 235 peraluminous granites 311ff. pericline 125 peridotite 7f. perovskite 144 perthite 235 petrological mixing models 103f. phengites 111f., 295f. phenocrysts, clinoenstatite 331 f. -, pillow basalts 1 f. -, two-mica granites 316 phlogopite 114, 223ff. phyllites 376 pillow lavas, chloritoid stability 165ff. -, development 5 -, microstructures 1 ff. pillow structures, greenstones 375 plagioclase 1, 37, 47, 155, 190, 235, 273, 295, 316, 341 f., 366, 399 -, inclusion in K-feldspar 82 plate tectonics, Indian ocean 387 plumbotectonics model 182 polymetamorphism, cordierites 135f. prehnite 235 preiswerkite 224 protoenstatite 336 pumpellyite 190, 235 pyrite 285, 295 pyrophyllite 170 pyroxenes, Mn-rich 417 -, two-  $\sim$  solvus 403f. pyroxmangite 261, 419

Quartz 47, 144, 166, 190, 201, 224, 235, 273, 285, 295, 316, 418 — diorite, Damara 357 — tholeites 400

Rare earth elements, granites 320 f.

—, Indian ocean basalts 395 f.

Rb/Sr ages, metamorphic biotites 249

— analyses, Damara granites 351

— , isochrons 356

reactions, chloritoid breakdown 169

rhodonite 255, 261, 417

— bustamite miscibility gap 262 f.

— –, geothermometry 264

rhyodacite 167

rhyolites 167, 271, 285, 294, 320

rutile 224

Sagenitization 251 saline series, Algeria 224f. sandstone 294 -, authigenic sheet silicates 295ff. -, -, mineral assemblages with depth 307 sanidine 30, 123f. sanidinite facies 143 -, index minerals 144 sapphirine 201, 235 scapolite 224 -, pegmatoid veins 345f. sericite, isotopic composition 287, 296, shale 167 sheet silicates, authigenic in Salton sandstones 295f. silicate liquids, CO2 dissolution 55ff. sillimanite 144, 235

sodian phlogopite 223f. solid solution, åkermanite 148 -, bustamite 419 sphalerite 145, 285, 295 sphene 145, 190, 295 spilite 167, 190 spinel 144, 155, 235f. spurrite 194 stilpnomelane 235 strain, feldspar inversion 125 stratified sulfide ores 285f. sulfide ores 285f. symplectite 157 synneusis 75ff. -, mechanisms 78 -, occurrence 79 system CaSiO<sub>3</sub>-CaMnSi<sub>2</sub>O<sub>6</sub>-CaFeSi<sub>2</sub>O<sub>6</sub> 253ff., 261ff. -, K2O-CaO-Al2O3-SiO2-H2O 29ff.

Talc 296, 418

- chlorite mixed layer 230

-, Na-bearing 224f.
thermodynamics, CO<sub>2</sub> in silicate melts 58 ff.

-, H<sub>2</sub>O in magmas 211 ff.
tholeiites 1, 7

-, Iceland 362 ff.
tirrodite 417

titanite 246
tonalite 36, 177, 311
tourmaline 224
trace elements, ignimbrites 274f.

—, Indian Ocean basalts 394f.

—, Norwegian greenstones 378f.

—, volcanics, Pindos 193
transition, cordierites 136f.
triclinicity, feldspars 124
trootolite 191
trondhjemite 36
twinning 75

—, clinoenstatite 331 f.

—, feldspars 80, 125

Ultramafic granulites 154 upper mantle 14f., 153, 206, 329, 403

Vermiculite 223, 296 –, d-spacings 297 vesuvianite 144

Wilkeite 145 wollastonite 144, 253f., 261, 419

Xonotlite 255

Zeolites 190 zoisite 30 zoning, growth clusters 76

## **List of Locations**

Achiltibuie, Scourie 154
Adirondacks, USA 143, 417
Alps, Western, Europe 110
Amar Idsas fault, Saudi Arabia 176
Amberg, Wisconsin 312
Arabian Sea 388
Arabian Shield 176

Balmat-Edwards district, Adirondacks
Baraboo, Wisconsin 312
Batopilas, Sa. Madre Occ. 272
Baukwab, Damara 355
Berlin, Wisconsin 312
Bjerkreim, Rogaland 236, 246
Bonin Islds., Japan 329
Boyer Lake, Ontario 167
Briançonnais, Western Alps 110
Cascade Slade, Adirondacks 143
Chichijima, Bonin Islds. 332
Columbia River, Brit. Columbia 68

Damara Belt, Namibia 355 Dent Blanche nappe, W. Alps 110 Derrag, Algeria 224

Elmore, Salton Sea 294
El-Mourdur, Algeria 224
Enderby Land, Antarctica 201
Erongo Mts., Namibia 355
Forbordfjell, Norway 376

Gavrovo Zone, Greece 190 Gran Paradiso, W. Alps 110 Gwenoro Dam area, Zimbabwe 36 Helen Mine, Ontario 166

Iceland 362 Indian Ocean 388

Jonsvatn, Norway 376

**K**eweenawan, Wisconsin 312 Kuroko, Kosaka, Japan 285

Lanzo, W. Alps 110 Lohrville, Wisconsin 312 Lugerville, Wisconsin 312

Marquette, Wisconsin 312
Meldon Quarry, Cornwall 266
Mica Creek area, Brit. Columbia 68
Mid-Atlantic Ridge 362
Monico, Wisconsin 312
Montello, Wisconsin 312
Mosinee, Wisconsin 312
Muko-jima, Bonin Islds. 329

Nagel Creek, Brit. Columbia 70 New London, Wisconsin 312 Nidely, Norway 376

Okatjiho Fault, Damara 355 Okombahe, Damara 355 Omaruru River, Damara 355 Orotsaub, Damara 355 Othris, Greece 190 Parnass Zone, Greece 190 Pelagonian Zone, Greece 190 Pindos, Greece 190 Pittsville, Wisconsin 312

Red Sea Region, Saudi Arabia 176 Reykjanes Ridge, Iceland 362 Rhodope Zone, Greece 190 Rogaland, Norway 236, 246

Salton Sea, California 294
Sayer Lake, Ontario 167
Scourie, Scotland 154
Sesia Zone, W. Alps 110
Sierra Madre Occ., Mexico 272
Sokndai, Rogaland 236, 246
Somali Basin, Indian Ocean 388
Spud Lake, Ontario 167

Tisselskog Area, S. Sweden 46 Trondheim Area, Norway 376 Tsomtsaub Fault, Damara 355

Uis, Damara 355 Utley, Wisconsin 312 Uwamuki, Kuroko 287

Vanoise, W. Alps 110 Vardar Zone, Greece 190 Vourinos, Greece 190

Waupaca, Wisconsin 312 Wolf River Batholith, Wisconsin 312